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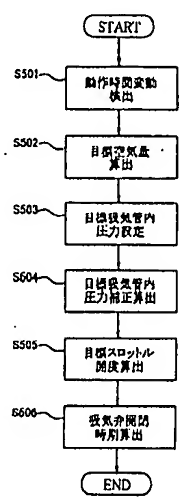
(54)【発明の名称】　エンジンの吸気制御装置

(57)【要約】

【課題】吸気弁の開閉時期を制御することでエンジンの吸入空気量を目標吸入空気量に制御するエンジンにおいて、吸気弁の開閉動作時間の変動によって、エンジンの吸入空気量が大きく変動することを防止する。

【解決手段】吸気弁の動作時間の変動量を検出し（Ｓ５０１）、また、エンジンの目標吸入空気量を設定する（Ｓ５０２）。ここで、前記変動量が大きいとき及び／又は目標吸入空気量が小さいときに、目標吸気管内圧力（Ｓ５０３）をより小さく補正する（Ｓ５０４）。そして、前記補正された目標吸気管内圧力及び目標吸入空気量に基づいて、目標スロットル開度，吸気弁の目標開閉時期を設定する（Ｓ５０５，Ｓ５０６）。



【特許請求の範囲】

【請求項１】エンジンの目標吸気通路内圧力を設定する目標吸気通路内圧力設定手段と、
少なくとも吸気弁の動作遅れ時間の変動量を検出する動作遅れ変動量検出手段と、
エンジンの目標吸入空気量を設定する目標吸入空気量設定手段と、
前記目標吸気通路内圧力を、少なくとも前記動作遅れ時間の変動量に基づいて補正する目標吸気通路内圧力補正手段と、
前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいてスロットル弁の開度を制御するスロットル開度制御手段と、
前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいて吸気弁の開閉時期を制御する吸気弁開閉時期制御手段と、
を含んで構成されたことを特徴とするエンジンの吸気制御装置。

【請求項２】前記目標吸気通路内圧力補正手段が、前記動作遅れ時間の変動量と目標吸入空気量とに基づいて前記目標吸気通路内圧力を補正するよう構成されたことを特徴とする請求項１記載のエンジンの吸気制御装置。

【請求項３】前記動作遅れ変動量検出手段が、前記吸気弁の開弁あるいは閉弁の指令を与えてから実際に開弁あるいは閉弁を開始するまでの時間を動作遅れ時間として検出することを特徴とする請求項１又は２記載のエンジンの吸気制御装置。

【請求項４】前記動作遅れ変動量検出手段が、前記吸気弁の開弁あるいは閉弁の指令を与えてから所定のリフト量になるまでの時間を動作遅れ時間として検出することを特徴とする請求項１又は２記載のエンジンの吸気制御装置。

【請求項５】前記動作遅れ変動量検出手段が、各気筒毎に検出した動作遅れ時間の平均値を算出すると共に、該平均値と各気筒の動作遅れ時間との偏差を算出し、前記偏差の絶対値の最大値を前記動作遅れ時間の変動量とすることを特徴とする請求項３又は４記載のエンジンの吸気制御装置。

【請求項６】前記動作遅れ変動量検出手段が、エンジン回転速度の変動量を前記動作遅れ時間の変動量に相関する値として検出することを特徴とする請求項１又は２記載のエンジンの吸気制御装置。

【請求項７】エンジンの目標吸気通路内圧力を設定する目標吸気通路内圧力設定手段と、
エンジンの目標吸入空気量を設定する目標吸入空気量設定手段と、
前記目標吸気通路内圧力を、少なくとも前記目標吸入空気量に基づいて補正する目標吸気通路内圧力補正手段と、
前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいてスロットル弁の開度を制御するスロットル開度制御手段と、
前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいて吸気弁の開閉時期を制御する吸気弁開閉時期制御手段と、
を含んで構成されたことを特徴とするエンジンの吸気制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はエンジンの吸気制御装置に関し、詳しくは、吸気弁の開閉時期を制御することによってエンジンの吸入空気量を目標吸入空気量に制御するよう構成された車両用エンジンに関する。

【０００２】

【従来の技術】従来、特開平９−２５６８２３号公報に開示されるように、エンジンの吸排気弁を電磁力により駆動し、吸排気弁の開閉時期を連続的に可変とする動弁機構があった。

【０００３】このような動弁機構を備えたエンジンでは、吸気絞り弁を備えないか、又は、吸気絞り弁を備える場合であっても吸気絞りを極力小さくして、吸気通路内圧力を大気圧に近い状態とし、吸気弁の開弁期間で吸入空気量の制御を行なうことによって、吸気絞り弁で吸入空気量制御を行なうエンジンと比較して吸気損失（ポンピングロス）を低減することが可能である。

【０００４】

【発明が解決しようとする課題】ところで、上記のような電磁力により吸排気弁を駆動する動弁機構においては、バルブスプリングの特性変化や、汚れやつまり等によるフリクションの変化、また、電磁力の磁気切れの変動等により、開弁あるいは閉弁の指令に対する開弁あるいは閉弁動作の遅れ時間（動作遅れ時間）が各気筒間でばらついたり、また、前記動作遅れ時間が１つの気筒で吸気毎に変動してしまう場合がある。

【０００５】吸気弁の開閉動作において上記のような動作遅れ時間の変動が発生した場合には、シリンダに吸入される空気量が時間的に変動したり、気筒間でシリンダに吸入される空気量にばらつきが生じることになる。特に、図１９に示すように、低負荷時においては高負荷時に比べ吸気弁の開弁時間が短くなって、全体の開弁時間に占める動作遅れ時間の割合が大きくなるため、エンジンに吸入される空気量の変動が大きくなり、アイドル安定性や運転性が悪化してしまう。

【０００６】本発明はこのような問題点に鑑みなされたもので、吸気弁の動作遅れ時間に変動が発生した場合においても、所望の吸入空気量に安定的に制御することができるエンジンの吸気制御装置を提供することを目的とする。

【０００７】

【課題を解決するための手段】そのため請求項１記載の

発明に係るエンジンの吸気制御装置は、図１に示すように構成される。

【０００８】図１において、目標吸気通路内圧力設定手段は、エンジンの目標吸気通路内圧力を設定する。動作遅れ変動量検出手段は、少なくとも吸気弁の動作遅れ時間の変動量を検出する。

【０００９】目標吸入空気量設定手段は、エンジンの目標吸入空気量を設定する。目標吸気通路内圧力補正手段は、前記目標吸気通路内圧力を、少なくとも前記動作遅れ時間の変動量に基づいて補正する。

【００１０】そして、スロットル開度制御手段は、前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいてスロットル弁の開度を制御する。また、吸気弁開閉時期制御手段は、前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいて吸気弁の開閉時期を制御する。

【００１１】かかる構成によると、目標吸気通路内圧力が吸気弁の動作遅れ時間の変動量に基づいて補正され、吸気弁の動作遅れ時間の変動による吸入空気量の変動を抑制する。

【００１２】即ち、同じ目標吸入空気量のときであっても、吸気通路内圧力が小さいと（負圧が大きいと）、より吸気弁の開弁時間を長くする必要が生じる一方、同じ動作遅れ時間であっても、吸気弁の開弁時間が長いほどシリンダ吸入空気量に与える影響は小さくなる。従って、吸気弁の動作遅れ時間の変動量が大きいときに、目標吸気通路内圧力を小さくすれば、吸気弁の開弁時間が長く修正され、結果、動作遅れ時間の変動に因るシリンダ吸入空気量の変動が小さくなる。

【００１３】尚、前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づき吸気弁の開閉時期を制御する吸気弁開閉時期制御手段においては、前記補正された目標吸気通路内圧力に基づいて制御された結果としての吸気通路内圧力を、センサで検出し又は推定して、吸気弁の開閉時期の制御に用いる構成としても良い。

【００１４】請求項２記載の発明では、前記目標吸気通路内圧力補正手段が、前記動作遅れ時間の変動量と目標吸入空気量とに基づいて前記目標吸気通路内圧力を補正する構成とした。

【００１５】かかる構成によると、動作遅れ時間の変動量が同じであっても、目標吸入空気量が多く吸気弁の開弁時間が長いために、全体の開弁時間に占める動作遅れ時間の割合が小さい場合には吸入空気量の変動が小さい。そこで、動作遅れ時間の変動量と共に目標吸入空気量を加味して目標吸気通路内圧力を補正する。

【００１６】請求項３記載の発明では、前記動作遅れ変動量検出手段が、前記吸気弁の開弁あるいは閉弁の指令を与えてから実際に開弁あるいは閉弁を開始するまでの時間を動作遅れ時間として検出する構成とした。

【００１７】かかる構成によると、吸気弁の開弁あるいは閉弁の指令を与えてから実際に吸気弁が動き出すまでの無駄時間が動作遅れ時間として検出され、前記無駄時間の変動に応じて目標吸気通路内圧力が補正される。

【００１８】請求項４記載の発明では、前記動作遅れ変動量検出手段が、前記吸気弁の開弁あるいは閉弁の指令を与えてから所定のリフト量になるまでの時間を動作遅れ時間として検出する構成とした。

【００１９】かかる構成によると、吸気弁の開弁あるいは閉弁の指令を与えてから実際に吸気弁が動き出すまでの無駄時間を含んで、所定のリフト量（例えば全開又は全閉）になるまでの動作時間が動作遅れ時間として検出され、前記動作遅れ時間の変動に応じて目標吸気通路内圧力が補正される。

【００２０】請求項５記載の発明では、前記動作遅れ変動量検出手段が、各気筒毎に検出した動作遅れ時間の平均値を算出すると共に、該平均値と各気筒の動作遅れ時間との偏差を算出し、前記偏差の絶対値の最大値を前記動作遅れ時間の変動量とする構成とした。

【００２１】かかる構成によると、各気筒毎に動作遅れ時間を検出し、各気筒毎の動作遅れ時間を平均化する。そして、各気筒毎の動作遅れ時間と前記平均値との偏差をそれぞれに求め、各気筒毎に求めた偏差の絶対値の中で最も大きな値を、動作遅れ時間の変動量とする。

【００２２】請求項６記載の発明では、前記動作遅れ変動量検出手段が、エンジン回転速度の変動量を動作遅れ時間の変動量に相関する値として検出する構成とした。かかる構成によると、動作遅れ時間の変動により吸入空気量に変動が生じ、吸入空気量の変動によってエンジン回転速度に変動が生じるので、エンジン回転速度の変動から動作遅れ時間の変動を推定する。

【００２３】一方、請求項７記載の発明に係るエンジンの吸気制御装置は、図２に示すように構成される。図２において、目標吸気通路内圧力設定手段は、エンジンの目標吸気通路内圧力を設定する。

【００２４】目標吸入空気量設定手段は、エンジンの目標吸入空気量を設定する。目標吸気通路内圧力補正手段は、前記目標吸気通路内圧力を、少なくとも前記目標吸入空気量に基づいて補正する。

【００２５】そして、スロットル開度制御手段は、前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいてスロットル弁の開度を制御する。また、吸気弁開閉時期制御手段は、前記補正された目標吸気通路内圧力と前記目標吸入空気量とに基づいて吸気弁の開閉時期を制御する。

【００２６】かかる構成によると、目標吸入空気量が多く吸気弁の開弁時間が長いために、全体の開弁時間に占める動作遅れ時間の割合が小さい場合には、たとえ動作遅れ時間の変動量が大きい場合であっても吸入空気量の変動が比較的小さいので、目標吸入空気量が大きい場合は、目標吸気通路内圧力は比較的高くて良く、目標吸入

空気量に応じて目標吸気通路内圧力を補正する。

【００２７】

【発明の効果】請求項１記載の発明によると、吸気弁の動作遅れ時間の変動に応じて吸気通路内圧力を補正することで、前記動作遅れ時間が全体の開弁時間に占める割合を減らし、前記動作遅れ時間の変動による吸入空気量の変動を抑止でき、運転性を向上させることができるという効果がある。

【００２８】請求項２記載の発明によると、吸入空気量が多く動作遅れ時間の変動が比較的許容されるときに、過度に吸気通路内圧力が小さく補正されポンピングロスが大きくなることを防止しつつ、吸入空気量が少ないときには効果的に吸入空気量の変動を抑止できるという効果がある。

【００２９】請求項３記載の発明によると、吸気弁に開弁又は閉弁の指令を与えてから実際に吸気弁が動き出すまで無駄時間の変動による吸入空気量の変動を抑止できるという効果がある。

【００３０】請求項４記載の発明によると、前記無駄時間を含む開弁又は閉弁に要する動作遅れ時間の変動による吸入空気量の変動を抑制できるという効果がある。請求項５記載の発明によると、各気筒間の動作時間のばらつきが大きいときに、該動作時間のばらつきの影響を抑制するように吸気通路内圧を補正できるという効果がある。

【００３１】請求項６記載の発明によると、吸気弁の動作時間の変動をエンジン回転速度の変動から容易に検出することができるという効果がある。請求項７記載の発明によると、吸入空気量が少なく、吸気弁の動作時間の変動が吸入空気量に大きな影響を与えるときに、吸気通路内圧を小さくして目標吸入空気量を得るために必要な開弁時間を長くして、前記動作時間の変動が吸入空気量に与える影響を抑制できるという効果がある。

【００３２】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づき詳細に説明する。図３は、実施の形態における車両用エンジンのシステム構成を示した図である。

【００３３】この図３において、エンジン１０１には、吸気ダクト１０２、吸気コレクタ１０３、吸気マニホールド１０４を介して空気が吸引される。前記吸気ダクト１０２には、吸入空気流量を検出するエアフローメータ１０５が設けられると共に、電子制御式スロットル弁１０６が介装されている。吸気マニホールド１０４の各ブランチ部には、燃料噴射弁１０７が設けられている。

【００３４】各気筒に設けられる吸気弁１０８及び排気弁１０９は、図４に示すような電磁駆動式のアクチュエータにより駆動される。各気筒の燃焼室には、点火栓１１０が設けられており、該点火栓１１０による火花着火により燃焼した排気は、前記排気弁１０９を介して排出され、排気マニホールド１１１によって導出される。前記排気マニホールド１１１の集合部には、空燃比センサ１１２が設けられ、排気中の酸素濃度を介して排気空燃比を検出する。

【００３５】ＥＣＵ（エンジン・コントロール・ユニット）１１３は、前記電子制御式スロットル弁１０６、燃料噴射弁１０７、点火栓１１０、及び、図４に示す吸排気弁１０８，１０９の電磁駆動式アクチュエータに駆動信号を出力する一方、前記エアフローメータ１０５、空燃比センサ１１２からの検出信号を入力する。即ち、前記ＥＣＵ１１３は、スロットル開度制御手段、吸気弁開閉制御手段としての機能を有している。

【００３６】また、前記ＥＣＵ１１３には、クランク角センサ１１４、水温センサ１１５、吸気温センサ１１６、アクセル操作量センサ１１７、車速センサ１１８からの検出信号が入力される。

【００３７】次に、図４に示した吸排気弁１０８、１０９の電磁駆動式アクチュエータについて説明する。図４において、吸排気弁２０２（吸気弁１０８又は排気弁１０９）は、シリンダヘッド２０１に対して摺動可能に支持されている。吸排気弁２０２の軸部には、バルブリテーナ２０３が固定されている。バルブリテーナ２０３とシリンダヘッド２０１の間には、バルブスプリング２０４が圧縮されて装着されており、これにより吸排気弁２０２はシリンダヘッド２０１のポート２０１ａを閉じる方向（閉弁方向）に付勢されることになる。

【００３８】シリンダヘッド２０１には装置の筐体部材２０５，２０６，２０７が固定されており、筐体内には電磁石２０８，２０９が設けられている。電磁石２０８，２０９は、直接筐体部材２０６，２０７に固定されて設置されている。また、電磁石２０８，２０９には、それぞれ電気コイル２０８ａ，２０９ａが設けられており、駆動回路により各電気コイルに電流が流されることで、電磁石２０８，２０９の吸引面２０８ｂ，２０９ｂが吸引力を発生することになる。

【００３９】電磁石２０８，２０９の中心部には、シャフト２１０が摺動可能に設置されており、該シャフト２１０の中間部分には、電磁石２０８の吸引面２０８ｂと電磁石２０９の吸引面２０９ｂとの間に、磁性体からなる可動板２１１が固定されている。これにより、電磁石２０８，２０９の何れに対して通電させるかにより、前記可動板２１１をシャフト２１０と一体に図で上下方向に駆動し得る構成となっている。

【００４０】また、シャフト２１０のシリンダヘッド２０１と反対側の端部にはスプリングシート２１４が固定されており、筐体に固定されたスプリングカバー２１６との間に圧縮されて設置された開弁スプリング２１５の作用により、シャフト２１０は開弁方向（図の下向き）に付勢されている。

【００４１】シャフト２１０は、吸排気弁２０２の軸部と同軸上に設けられており、シャフト２１０のシリンダ

ヘッド側の端部は、吸排気弁２０２の軸の頂面２０２ａと対向している。そのため、シャフト２１０に開弁方向（図の下向き）の力が作用した場合には、シャフト２１０が吸排気弁２０２を押し、吸排気弁２０２を開弁することになり、逆にシャフト２１０が閉弁方向（図の上向き）に移動した場合には、吸排気弁２０２はポート２０１ａを塞ぐまで閉弁方向に変位することになる。

【００４２】このようにして、電磁石２０８，２０９の吸引動作により、バルブの開閉を可能にしている。変位センサ２１７は、シャフト２１０の変位を計測するセンサであり、例えばポテンショメータを使用してシャフト２１０の変位を検出する。

【００４３】以下に、上記構成による吸気制御の詳細を、マイクロコンピュータで実行されるプログラムを示すフローチャート等の図面に基づいて説明する。尚、以下に示す各プログラムは、例えば１０msec毎に実行されるものとする。

【００４４】図５は吸気制御の第１の実施形態を示す基本のフローチャートである。Ｓ５０１（動作遅れ変動量検出手段）では、各気筒の吸気弁１０８の閉弁に要する時間（動作時間）を検出し、これに基づいて吸気弁１０８の動作時間の変動を算出する。尚、閉弁に要する時間と共に、又は、閉弁に要する時間に代えて、開弁に要する時間を検出し、該開弁時間から動作時間の変動を算出させても良い。

【００４５】Ｓ５０２（目標吸入空気量設定手段）では、シリンダに吸入する目標吸入空気量を算出し、Ｓ５０３（目標吸気通路内圧力設定手段）において目標吸気管内圧力を設定する。

【００４６】Ｓ５０４（目標吸気通路内圧力補正手段）では、前記目標吸気管内圧力を前記動作時間の変動に基づいて補正し、Ｓ５０５（スロットル開度制御手段）では、前記補正された目標吸気管内圧力と前記目標吸入空気量とに基づいて目標スロットル開度を算出し、Ｓ５０６（吸気弁開閉時期制御手段）では、前記補正された目標吸気管内圧力と前記目標吸入空気量とに基づいて吸気弁１０８の開閉時期を算出し、処理を終了する。

【００４７】図６は吸気制御の第２の実施形態を示す基本のフローチャートである。Ｓ６０１（目標吸気通路内圧力設定手段）では目標吸気管内圧力を設定し、Ｓ６０２（目標吸入空気量設定手段）ではシリンダに吸入する目標吸入空気量を算出する。

【００４８】Ｓ６０３（目標吸気通路内圧力補正手段）では目標吸気管内圧力を目標吸入空気量に基づき補正し、Ｓ６０４（スロットル開度制御手段）では、前記補正された目標吸気管内圧力と前記目標吸入空気量とに基づいて目標スロットル開度を算出し、Ｓ６０５（吸気弁開閉時期制御手段）では、前記補正された目標吸気管内圧力と前記目標吸入空気量とに基づいて吸気弁１０８の開閉時期を算出し、処理を終了する。

【００４９】図７は、前記図５において動作時間の変動の算出を行うＳ５０１（動作遅れ変動量検出手段）の処理内容を詳しく示したフローチャートである。Ｓ７０１では、吸気弁１０８のリフト量を測定する変位センサ２１７を用い、各気筒の吸気弁１０８の閉弁時間Ｔｎ（ｎ＝１，…，４）を測定する。前記閉弁時間Ｔｎ（動作遅れ時間）は、吸気弁１０８に閉弁の指令を与えてから実際に閉弁を開始するまでの時間、又は、吸気弁１０８に閉弁の指令を与えてから実際に閉弁される（所定のリフト量になる）までの時間とする。

【００５０】但し、吸気弁１０８に開弁の指令を与えてからの時間として動作遅れ時間を求めても良く、更には、閉弁側と開弁側との双方で動作遅れ時間を測定させても良い。また、排気弁の動作遅れもエンジンの吸入空気量に影響を及ぼすので、吸気弁の動作遅れ時間と共に、排気弁の動作遅れ時間も測定させる構成としても良い。

【００５１】Ｓ７０２では、各気筒の閉弁時間Ｔｎの平均値Ｂを算出する。Ｓ７０３では、各気筒毎の閉弁時間Ｔｎと平均値Ｂとの偏差Ｔｎ－Ｂの絶対値を算出し、それらの最大値を時間変動量Ｄとする。

【００５２】ところで、上記図７では、変位センサ２１７を用いて閉弁時間Ｔｎを測定するようにしたが、閉弁時間Ｔｎの変動があると、エンジンの吸入空気量が変動し、これにより、エンジン回転速度Ｎｅが変動することになるので、図８に示すようにして、エンジン回転速度Ｎｅの変動から前記時間変動量Ｄを推定することができる。

【００５３】図８において、まず、Ｓ８０１では、エンジン回転速度Ｎｅを読み込む。Ｓ８０２では、前記読み込んだエンジン回転速度Ｎｅに対して、下記の式１に示すようなハイパスフィルタ処理（カットオフ周波数は例えば1Ｈｚ）を施し、低周波成分を除去する。

【００５４】

$$y(k)=0.9695312529\times\{u(k)-u(k-1)\}+0.9390625058\times y(k-1)\cdots(1)$$

上記式１において、ｕ（ｋ）はフィルタの入力の最新値、ｕ（ｋ－１）は入力の前回値、ｙ（ｋ）はフィルタ出力の最新値、ｙ（ｋ－１）は出力の前回値である。

【００５５】次にＳ８０３では、ハイパスフィルタの出力の絶対値を計算する。そして、Ｓ８０４では、ハイパスフィルタの出力の絶対値に対して、下記の式２に示すようなローパスフィルタ処理（カットオフ周波数は例えば10Ｈｚ）を施して所定期間（例えば10秒間）データの積分を行ない、その結果を吸気弁１０８の動作時間の変動量Ｄとする。

【００５６】

$$y(k)=0.2452372753\times\{u(k)-u(k-1)\}+0.5095254495\times y(k-1)\cdots(2)$$

図９は、図５及び図６において目標吸入空気量の算出を行うＳ５０２，Ｓ６０２（目標吸入空気量設定手段）における処理内容を詳しく示したフローチャートである。

【００５７】Ｓ９０１では、アイドル運転における要求空気量に相当するアイドル保持空気流量を読み込み、Ｓ９０２では、前記アイドル保持空気流量に対して、ソニック流でのスロットル通過流量とスロットル開口面積との関係を表わす係数を乗算してアイドル安定化分スロットル開口面積Ａｉを求める。

【００５８】Ｓ９０３では、アクセル開度を読み込み、Ｓ９０４では、アクセル開度をスロットル開口面積に変換するマップからアクセル分スロットル開口面積Ａａを算出する。

【００５９】Ｓ９０５では、アイドル安定化分スロットル開口面積ＡｉとアクセルSスロットル開口面積Ａａとを加算してスロットル開口面積Ａを求める。Ｓ９０６では、スロットル開口面積Ａ，エンジン回転速度Ｎｅ，排気量Ｖを用いて、スロットル開口面積Ａを回転速度Ｎｅと排気量Ｖで除算した値ＡＮＶ（＝Ａ／（Ｎｅ・Ｖ））を算出し、次のＳ９０７では、予め前記ＡＮＶに応じて目標体積流量比ＱＨ０（行程容積に対する新気量の標準状態での体積）を記憶したマップを参照し、そのときの前記ＡＮＶに対応する目標体積流量比ＱＨ０を算出する。

【００６０】尚、前記目標体積流量比ＱＨ０のマップは、例えば吸気弁１０８の開時期ＩＶＯを上死点ＴＤＣ、閉時期ＩＶＣを下死点ＢＤＣとした場合に対応させて設定されている。

【００６１】図１０は、図５及び図６において目標吸気管内圧力の設定を行うＳ５０３，Ｓ６０１（目標吸気通路内圧力設定手段）における処理内容を詳しく示したフローチャートである。

【００６２】Ｓ１００１では冷却水の温度を読み込み、Ｓ１００２においては冷却水温度に基いて目標吸気管内圧力を設定するマップを検索し、目標吸気管内圧力を算出する。尚、目標吸気管内圧力は、冷機時は比較的小さい圧力を設定し、混合気の流速を速めガス流動を強くすることによって、燃焼安定性を向上させる。また、暖機時には、大気圧に近い大きな値に設定し、吸気損失（ポンピングロス）を低減することによって、燃料消費率を小さくする。例えば、冷機時（摂氏０度未満）においては目標吸気管内圧力を－２００mmHg、暖機時（摂氏80度以上）においては－５０mmHgとし、摂氏０度以上から摂氏80度未満の場合には、－２００mmHgから－５０mmHgを結ぶ直線上の値に設定することとする。

【００６３】図１１は、図５の目標吸気管内圧力の補正を行うＳ５０４（目標吸気通路内圧力補正手段）における処理内容を詳しく示したフローチャートである。Ｓ１１０１では、フラグＦｎｅｗの値をフラグＦｏｌｄにセットする。尚、フラグＦｏｌｄの初期値は０とする。

【００６４】Ｓ１１０２では、目標吸気管内圧力Ｐｔを読み込み、Ｓ１１０３では時間変動量Ｄを読み込む。Ｓ１１０４では、時間変動量Ｄと予め決定しておいた所定値ε１とを比較し、大小判別を行う。

【００６５】Ｓ１１０４で時間変動量Ｄがε１よりも大きいと判別された場合には、Ｓ１１０５へ進み、フラグＦｎｅｗに１をセットする。次のＳ１１０６では、フラグＦｏｌｄの判別を行い、Ｆｏｌｄ＝１であった場合には、Ｓ１１０７へ進んで、変数ｉから１を引く処理を行なう。

【００６６】一方、Ｆｏｌｄ＝０であった場合には、Ｓ１１０８へ進み、変数ｉに定数ｈを入れる。Ｓ１１０９では、前記変数ｉの正負の判断をし、負であった場合には、Ｓ１１１０へ進み、目標吸気管内圧力Ｐｔから定数αを引いたものを補正吸気管内圧力Ｐｃとし、前記変数ｉが０又は正の値であった場合は、そまま処理を終了させる。

【００６７】上記Ｓ１１０５からＳ１１１０までの処理により、具体的には変数ｉが負になるまでの時間だけ時間変動量Ｄがε１よりも大きいと判断されたとき、目標吸気管内圧力を低く補正することになる。例えば定数ｈの値を３００とした場合、３秒間継続して時間変動量Ｄがε１よりも大きいと判断されたときに、Ｓ１１１０へ進み、目標吸気管内圧力を低く補正する。

【００６８】一方、Ｓ１１０３で時間変動量Ｄがε１よりも小さいと判別された場合には、上記Ｓ１１０５からＳ１１１０までの処理と同様な処理を行なうＳ１１１１からＳ１１１６まで処理により、時間変動量Ｄがε１より小さい状態の継続時間が定数ｈの値で規定される時間を越えると、Ｓ１１１６へ進み、目標吸気管内圧力を定数αだけ高くする。

【００６９】即ち、図１１に示される目標吸気管内圧力の補正処理は、横軸に時間変動量、縦軸に負荷をとる図１６に示すように、負荷の量には依存せず、時間変動量が小さい場合には高く、時間変動量が大きい場合は低く補正するものである。従って、時間変動量Ｄを３段階以上に判別して、該判別結果に応じて異なる補正量で目標吸気管内圧力を補正する構成であっても良い。

【００７０】このように時間変動量が大きいときに、吸気管内圧力を低くすれば、吸気弁の開閉時期の制御によって目標の吸入空気量を得るためには、開弁時間を長くするする必要が生じ、以て、全体の開弁時間に占める動作時間の割合が減って、動作時間の変動による吸入空気量の変動を抑制できることになる。

【００７１】ところで、図５の目標吸気管内圧力の補正を行うＳ５０４（目標吸気通路内圧力補正手段）における処理を、前記図１１に示したものに代えて、図１２に示すように、負荷の量及び時間変動量に依存させて行なわせるようにしても良い。

【００７２】図１２において、Ｓ１２０１からＳ１２１

６までの各ステップにおいては、図１１のＳ１１０１からＳ１１１６と同様に、前記時間変動量Ｄに基づいて、動作時間変動量が大きい場合は目標吸気管内圧力Ｐｔを低く補正し、動作時間変動量が小さい場合には目標吸気管内圧力Ｐｔを高く補正する。

【００７３】更に、Ｓ１２１７では、目標体積流量比ＱＨ０を読み込み、Ｓ１２１８では、予め決定した所定値ε２と目標体積流量比ＱＨ０とを比較することによって負荷を判断する。

【００７４】そして、高負荷（ＱＨ０＞ε２）の場合には、Ｓ１２１９へ進み、目標体積流量比ＱＨ０と所定値ε２との偏差に係数ｋを乗算して求めた補正値を、目標吸気管内圧力Ｐｔに加算した結果を、最終的な目標吸気管内圧力Ｐｃとする。

【００７５】$Pc = (QH0 - \varepsilon 2) \times k + Pt$

一方、低負荷（ＱＨ０≦ε２）の場合には、補正を加えることなく、目標吸気管内圧力Ｐｔをそのまま最終的な目標吸気管内圧力Ｐｃにセットする。

【００７６】即ち、図１２に示される目標吸気管内圧力の補正処理は、横軸に時間変動量、縦軸に負荷をとる図１７に示すように、負荷が所定値以下の場合は、負荷に関わらず、目標吸気管内圧力は時間変動量が小さい場合には高く、時間変動量が大きい場合は低く補正される。また、負荷が所定値以上の場合は、目標吸気管内圧力は、時間変動量が小さい場合には高く、時間変動量が大きい場合は低く補正されると共に、負荷が大きい場合ほど目標吸気管内圧力はより高く補正される。

【００７７】負荷が大きく、吸気弁の開弁時間が比較的長い場合には、たとえ時間変動量が大きい場合であっても、全体の開弁時間に与える影響が比較的小さいので、目標吸気管内圧力を小さくする必要性が薄くなる。そこで、時間変動量が同じであってもそのときの負荷に応じて目標吸気管内圧力を補正し、必要以上に標吸気管内圧力が低く補正されて、吸気損失（ポンピングロス）が増大することを防止する。

【００７８】尚、上記図１１又は図１２に示される目標吸気管内圧力の補正を、前記図７で検出した動作時間変動量に基づいて行なう場合には、目標吸気管内圧力が大気圧付近であるときに行い、減速要求に応じて目標吸気管内圧力が小さく設定されているときには行なう必要はない。即ち、図７において実際の吸気弁のリフト状態から求められる動作時間の変動量は、吸気管内圧力を補正しても変化せず、たとえ吸入空気量の変動を小さくできる程度に目標吸気管内圧力が小さい状態であっても、目標吸気管内圧力の減少補正要求を示すことになるためである。

【００７９】図１３は図６の目標吸気管内圧力の補正を行うＳ６０３（目標吸気通路内圧力補正手段）における処理内容を詳しく示したフローチャートである。Ｓ１３０１では目標吸気管内圧力Ｐｔを読み込み、Ｓ１３０２では目標体積流量比ＱＨ０を読み込む。

【００８０】Ｓ１３０３では目標体積流量比ＱＨ０に応じて吸気管内圧力補正量Ｐｒを記憶したマップから、そのときの目標体積流量比ＱＨ０に対応する補正量Ｐｒを算出し、Ｓ１３０４では目標吸気管内圧力Ｐｔから前記吸気管内圧力補正量Ｐｒを引いて補正吸気管内圧力Ｐｃを算出する。

【００８１】前記吸気管内圧力補正量Ｐｒは、目標体積流量比ＱＨ０が小さい時ほど大きな値の設定されるようになっており、目標体積流量比ＱＨ０（エンジン負荷）が小さいときほど目標吸気管内圧力Ｐｔがより小さく補正される。

【００８２】即ち、図１３に示される目標吸気管内圧力の補正処理は、時間変動量には依存せず、負荷が小さい場合には低く、負荷が大きい場合は高く補正するものである。

【００８３】図１４は、図５及び図６の目標スロットル開度の算出を行うＳ５０５，Ｓ６０４（スロットル開度制御手段）における処理内容を詳しく示したフローチャートである。

【００８４】Ｓ１４０１では、目標体積流量比ＱＨ０を読み込み、Ｓ１４０２では、補正処理が施された吸気管内圧力Ｐｃを読み込む。次にＳ１４０３～Ｓ１４０８での演算を、図１８を用いて説明する。

【００８５】吸気管内圧力を一定とした場合、スロットル開口面積Ａを回転速度Ｎｅと排気量Ｖで除算した値Ａ／（Ｎｅ・Ｖ）と体積流量比ＱＨ０は比例関係となり、図１８に直線で示される関係となる。ここで、吸気管内圧力が目標値となるようにスロットル開口面積Ａを求めることになるが、その吸気管内圧力の状態で吸気弁の開閉時期を制御して吸入できる空気量には限界（ＱＨＯｍａｘ）があるため、限界以上の要求空気量に対しては、吸気弁の閉時期ＩＶＣを下死点ＢＤＣ固定とし、吸気管内圧力を目標よりも高くして対応する。

【００８６】これを行うため、Ｓ１４０３では、図１８の直線の傾き（吸気管内圧力が一定時のＡ／（Ｎｅ・Ｖ）とＱＨ０との比率）を、そのときの目標吸気管内圧力に基づき予め定めたマップを参照して算出する。

【００８７】Ｓ１４０４では、目標体積流量比ＱＨ０に前記の傾きを乗算して、目標吸気管内圧力におけるＡ／（Ｎｅ・Ｖ）を算出し、これをＡＮＶｅにセットする。一方、Ｓ１４０５では、吸気弁閉時期ＩＶＣを下死点ＢＤＣ固定とした場合のＡ／（Ｎｅ・Ｖ）を、図１８の曲線で示したデータをマップとして持たせて算出し、これをＡＮＶｍにセットする。

【００８８】Ｓ１４０６では、前記ＡＮＶｅとＡＮＶｍの大小を比較して、Ｓ１４０７又はＳ１４０８においてその値の大きい方に対してエンジン回転速度Ｎｅと排気量Ｖを乗算して目標スロットル開口面積Ａｔを算出する。

【００８９】Ｓ１４０９では、目標スロットル開口面積Ａｔを目標スロットル開度に変換するマップを検索し、目標スロットル開度を算出する。ＥＣＵ１１３は、前記目標スロットル開度に基づく駆動信号を前記電子制御式スロットル弁１０６に出力し、スロットル弁の開度を目標スロットル開度に制御する。

【００９０】図１５は、図５及び図６の吸気弁開閉時期の算出を行うＳ５０６，Ｓ６０５（吸気弁開閉時期制御手段）における処理内容を詳しくフローチャートである。尚、ここでは、吸気弁の開弁時期は上死点ＴＤＣに固定し、閉弁時期を以下に示す方法で演算するものとする。

【００９１】Ｓ１５０１では、補正された目標吸気管内圧力Ｐｃを読み込み、Ｓ１５０２では、その目標吸気管内圧力Ｐｃとし、かつ、吸気弁の閉時期を下死点ＢＤＣとした場合の最大体積流量比ＱＨＯｍａｘを、予め定めておいたマップデータを用いて算出する。

【００９２】Ｓ１５０３では、目標体積流量比ＱＨ０を読み込み、Ｓ１５０４では、目標体積流量比ＱＨ０と最大体積流量比ＱＨＯｍａｘに基づいて、吸気弁の開弁時間を以下のようにして算出し、吸気弁の閉時期を決定する。

【００９３】吸気弁の開弁時間＝１８０°ＣＡ×ＱＨ０／ＱＨＯｍａｘ

ＥＣＵ１１３は、前記吸気弁の閉時期に基づく駆動信号を前記電磁駆動式アクチュエータに出力し、上死点ＴＤＣで吸気弁１０８を開き、前記決定された閉時期で吸気弁１０８を閉じる。

【図面の簡単な説明】

【図１】請求項１記載の発明の構成を示すブロック図。

【図２】請求項７記載の発明の構成を示すブロック図。

【図３】実施の形態のエンジンを示すシステム構成図。

【図４】吸排気弁の電磁駆動式アクチュエータを示す断面図。

【図５】吸入空気量の制御の第１実施形態を示すフローチャート。

【図６】吸入空気量の制御の第２実施形態を示すフローチャート。

【図７】動作時間変動量の検出を示すフローチャート。

【図８】動作時間変動量の検出の他例を示すフローチャート。

【図９】目標吸入空気量の設定を示すフローチャート。

【図１０】目標吸気管内圧力の設定を示すフローチャート。

【図１１】変動量に基づく目標吸気管内圧力の補正を示すフローチャート。

【図１２】変動量及び目標空気量に基づく目標吸気管内圧力の補正を示すフローチャート。

【図１３】目標空気量に基づく目標吸気管内圧力の補正を示すフローチャート。

【図１４】目標スロットル開度の算出を示すフローチャート。

【図１５】吸気弁の開閉時期の算出を示すフローチャート。

【図１６】変動量に基づく目標吸気管内圧力の補正の特性を示す線図。

【図１７】変動量及び目標空気量に基づく目標吸気管内圧力の補正の特性を示す線図。

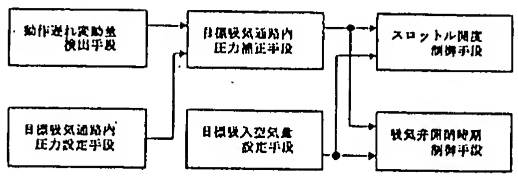
【図１８】Ａ／（Ｎｅ・Ｖ）と目標体積流量比との相関を示す線図。

【図１９】吸気弁の動作時間の変動による影響を負荷毎に示すタイミングチャート。

【符号の説明】

１０１…エンジン
１０２…吸気ダクト
１０３…吸気コレクタ
１０４…吸気マニホールド
１０５…エアフローメータ
１０６…電子制御式吸気絞り弁
１０７…燃料噴射弁
１０８…吸気弁
１０９…排気弁
１１０…点火栓
１１１…排気マニホールド
１１２…空燃比センサ
１１３…ＥＣＵ（エンジン・コントロール・ユニット）
１１４…クランク角センサ
１１５…水温センサ
１１６…吸気温センサ
１１７…アクセル操作量センサ
１１８…車速センサ

【図1】



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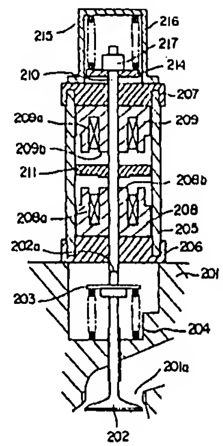

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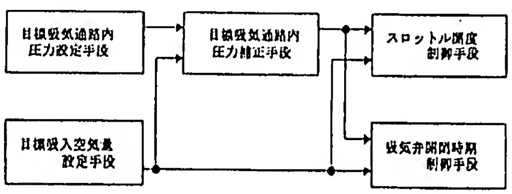

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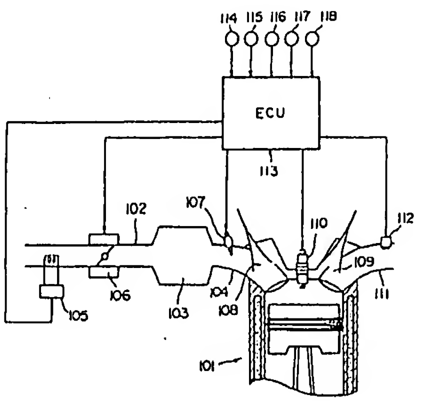

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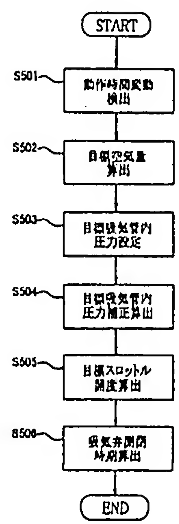

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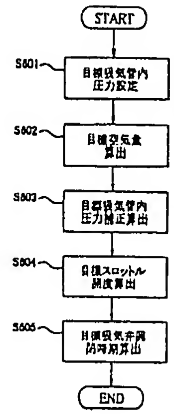

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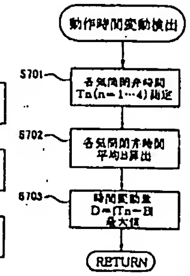

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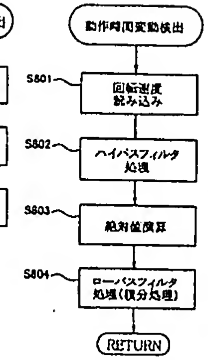

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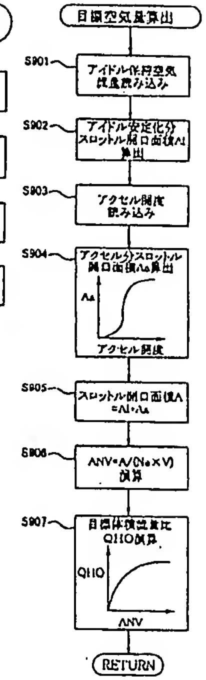

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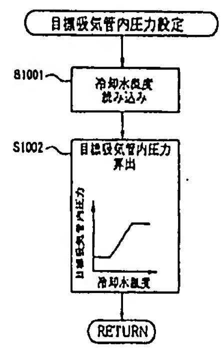

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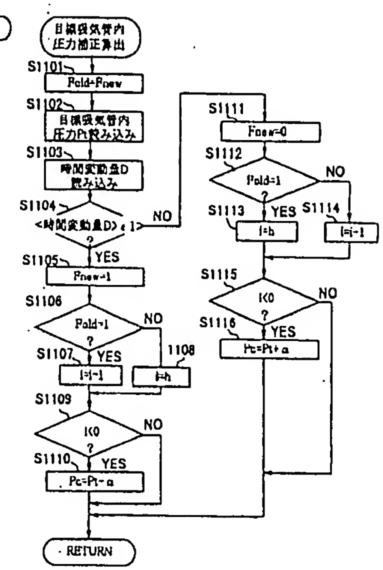

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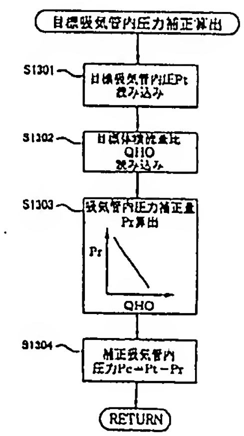
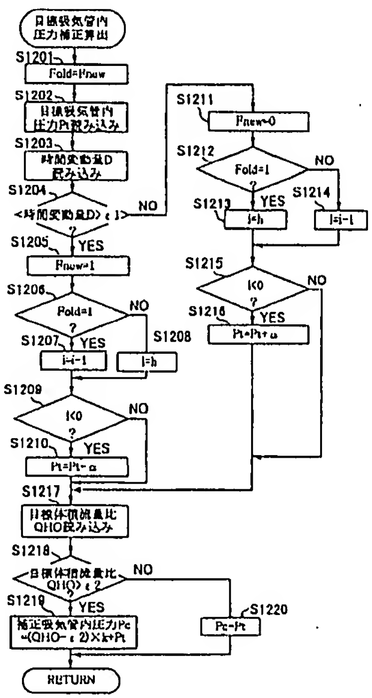
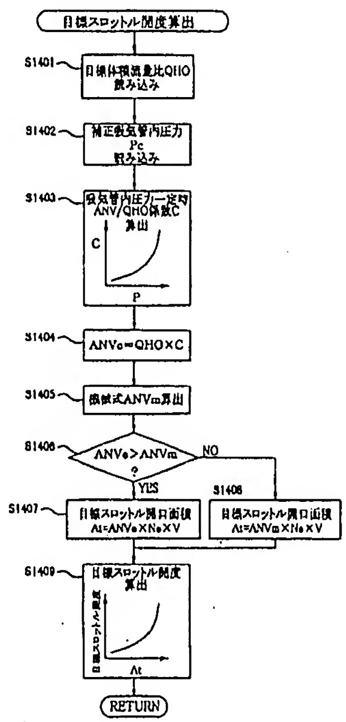


【図１２】



【図１４】



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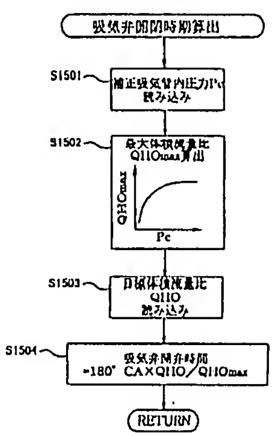

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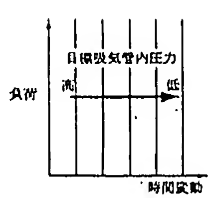

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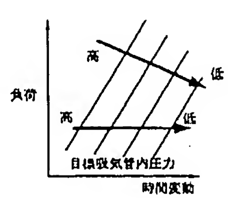

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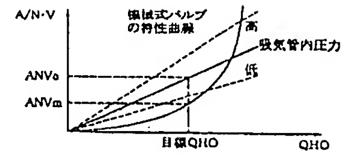
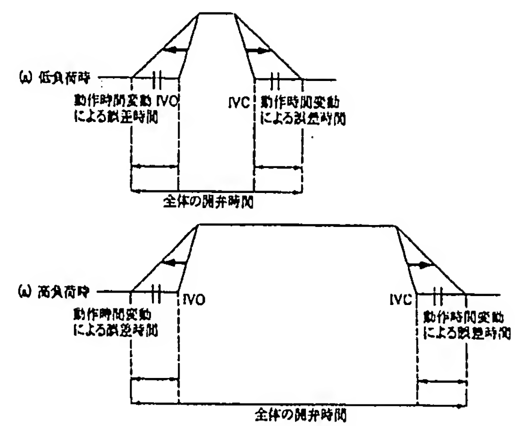


【図１９】



フロントページの続き

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EB07 FA03 FA09 FA25 FA36
GA02 HA01X HA01Z HA04Z
HA05X HA06X HA13X HA13Z
HD05Z HE02Z HE03Z HE08Z
HF08Z HF21Z

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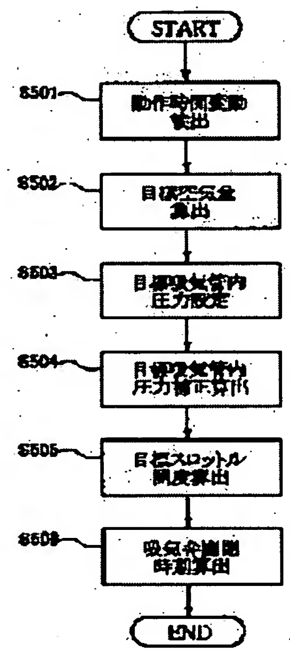
(54) INTAKE CONTROL DEVICE FOR ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the occurrence of a wide fluctuation in an amount of intake air of an engine through the fluctuation of an opening and closing operation time of an intake valve, in an engine to control an intake air amount of an engine to a target intake air amount by controlling an opening and closing timing of the intake valve.

SOLUTION: A fluctuation amount of an operation time of an intake valve is detected (S501) and a target intake air amount of an engine is set (S502). In this case, when a fluctuation amount is high and/or a target intake air amount is low, a target pressure in an intake air pipe (S503) is corrected to a lower value (S504). Based on a corrected target pressure in an intake pipe and a target intake air amount, a target throttle opening and a target opening closing timing of an intake valve is set (S505 and S506).



LEGAL STATUS

[Date of request for examination]

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rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] An aim inhalation-of-air path internal pressure setting means to set up engine aim inhalation-of-air path internal pressure, An amount detection means of delay fluctuation of operation to detect the amount of fluctuation of a time delay of an inlet valve of operation at least, An aim inhalation air content setting means to set up an engine aim inhalation air content, and an aim inhalation-of-air path internal pressure amendment means to amend said aim inhalation-of-air path internal pressure based on the amount of fluctuation of said time delay of operation at least, A throttle opening control means which controls opening of a throttle valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content, An inhalation-of-air control unit of an engine characterized by being constituted including an inlet-valve closing motion stage control means which controls a closing motion stage of an inlet valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content.
[Claim 2] An inhalation-of-air control unit of an engine according to claim 1 characterized by constituting said aim inhalation-of-air path internal pressure amendment means so that said aim inhalation-of-air path internal pressure may be amended based on the amount of fluctuation and an aim inhalation air content of said time delay of operation.
[Claim 3] An inhalation-of-air control unit of an engine according to claim 1 or 2 with which said amount detection means of delay fluctuation of operation is characterized by detecting time amount after giving a command of valve opening of said inlet valve, or clausilium until it actually starts valve opening or clausilium as a time delay of operation.
[Claim 4] An inhalation-of-air control unit of an engine according to claim 1 or 2 with which said amount detection means of delay fluctuation of operation is characterized by detecting time amount after giving a command of valve opening of said inlet valve, or clausilium until it becomes the predetermined amount of lifts as a time delay of operation.
[Claim 5] An inhalation-of-air control unit of an engine according to claim 3 or 4 characterized by computing deflection of this average and a time delay of each gas column of operation, and making maximum of an absolute value of said deflection the amount of fluctuation of said time delay of operation while said amount detection means of delay fluctuation of operation computes the average of a time delay of operation detected for every gas column.
[Claim 6] An inhalation-of-air control unit of an engine according to claim 1 or 2 with which said amount detection means of delay fluctuation of operation is characterized by detecting as a value which correlates the amount of fluctuation of an engine speed with the amount of fluctuation of said time delay of operation.
[Claim 7] An aim inhalation-of-air path internal pressure setting means to set up engine aim inhalation-of-air path internal pressure, An aim inhalation air content setting means to set up an engine aim inhalation air content, and an aim inhalation-of-air path internal pressure amendment means to amend said aim inhalation-of-air path internal pressure based on said aim inhalation air content at least, A throttle opening control means which controls opening of a throttle valve based on said amended aim

inhalation-of-air path internal pressure and said aim inhalation air content, An inhalation-of-air control unit of an engine characterized by being constituted including an inlet-valve closing motion stage control means which controls a closing motion stage of an inlet valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the engine for vehicles constituted so that an engine inhalation air content might be controlled to an aim inhalation air content by controlling the closing motion stage of an inlet valve in detail about an engine inhalation-of-air control unit.
[0002]
[Description of the Prior Art] The engine induction-exhaust valve was driven according to electromagnetic force, and there was a valve gear which makes adjustable continuously the closing motion stage of an induction-exhaust valve so that it might be conventionally indicated by JP,9-256823,A.
[0003] It is possible to reduce inhalation-of-air loss (pumping loss) by the inhalation-of-air throttle valve as compared with the engine which performs inhalation air content control by making inhalation-of-air drawing small as much as possible, even if it is the case where do not have an inhalation-of-air throttle valve, or it has an inhalation-of-air throttle valve with the engine equipped with such a valve gear, making inhalation-of-air path internal pressure into the condition near atmospheric pressure, and controlling an inhalation air content by the valve-opening period of an inlet valve.
[0004]
[Problem(s) to be Solved by the Invention] By the way, in the valve gear which drives an induction-exhaust valve according to the above electromagnetic force, by property change of a valve spring, change of friction with a dirt fellow ball etc., fluctuation of the magnetic piece of electromagnetic force, etc., the time delay (time delay of operation) of valve opening, valve opening to the command of clausilium, or clausilium actuation may vary between each gas column, and said time delay of operation may be changed for every inhalation of air in one gas column.
[0005] When fluctuation of the above time delays of operation occurs in the switching action of an inlet valve, the air content inhaled by the cylinder will be changed in time, or dispersion will arise in the air content inhaled by the cylinder between gas columns. Since the valve-opening time amount of an inlet valve becomes short compared with the time of a heavy load at the time of a low load and the rate of the time delay of operation occupied to the whole valve-opening time amount becomes large as especially shown in drawing 19 , fluctuation of the air content inhaled by the engine will become large, and idle stability and operability will get worse.
[0006] This invention was made in view of such a trouble, and when fluctuation occurs in the time delay of an inlet valve of operation, it aims at offering the inhalation-of-air control unit of an engine stably controllable to a desired inhalation air content.
[0007]
[Means for Solving the Problem] Therefore, an inhalation-of-air control unit of an engine concerning invention according to claim 1 is constituted as shown in drawing 1 .
[0008] In drawing 1 , an aim inhalation-of-air path internal pressure setting means sets up engine aim

inhalation-of-air path internal pressure. The amount detection means of delay fluctuation of operation detects the amount of fluctuation of a time delay of an inlet valve of operation at least.

[0009] An aim inhalation air content setting means sets up an engine aim inhalation air content. An aim inhalation-of-air path internal pressure amendment means amends said aim inhalation-of-air path internal pressure based on the amount of fluctuation of said time delay of operation at least.

[0010] And a throttle opening control means controls opening of a throttle valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content. Moreover, an inlet-valve closing motion stage control means controls a closing motion stage of an inlet valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content.

[0011] According to this configuration, aim inhalation-of-air path internal pressure is amended based on the amount of fluctuation of a time delay of an inlet valve of operation, and fluctuation of an inhalation air content by fluctuation of a time delay of an inlet valve of operation is controlled.

[0012] That is, while it will be necessary to lengthen valve-opening time amount of an inlet valve more if inhalation-of-air path internal pressure is small even if it is at the time of the same aim inhalation air content (if negative pressure is large), even if it is the same time delay of operation, effect which it has on a cylinder inhalation air content becomes small, so that valve-opening time amount of an inlet valve is long. Therefore, if aim inhalation-of-air path internal pressure is made small when the amount of fluctuation of a time delay of an inlet valve of operation is large, valve-opening time amount of an inlet valve will be corrected for a long time, and fluctuation of a cylinder inhalation air content based on fluctuation of a result and a time delay of operation will become small.

[0013] In addition, in an inlet-valve closing-motion stage control means which controls a closing-motion stage of an inlet valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content, it is good also as a configuration which detects or presumes inhalation-of-air path internal pressure as a result controlled based on said amended aim inhalation-of-air path internal pressure by sensor, and is used for control of a closing motion stage of an inlet valve.

[0014] In invention according to claim 2, said aim inhalation-of-air path internal pressure amendment means considered as a configuration which amends said aim inhalation-of-air path internal pressure based on the amount of fluctuation and an aim inhalation air content of said time delay of operation.

[0015] Even if the amount of fluctuation of a time delay of operation is the same, since [with many aim inhalation air contents] valve-opening time amount of an inlet valve is long, when a rate of a time delay of operation occupied to the whole valve-opening time amount is small, fluctuation of an inhalation air content is small according to this configuration. Then, with the amount of fluctuation of a time delay of operation, an aim inhalation air content is considered and aim inhalation-of-air path internal pressure is amended.

[0016] In invention according to claim 3, said amount detection means of delay fluctuation of operation considered as a configuration which detects time amount after giving a command of valve opening of said inlet valve, or clausilium until it actually starts valve opening or clausilium as a time delay of operation.

[0017] According to this configuration, a dead time after giving a command of valve opening of an inlet valve or clausilium until an inlet valve actually begins to move is detected as a time delay of operation, and aim inhalation-of-air path internal pressure is amended according to fluctuation of said dead time.

[0018] In invention according to claim 4, said amount detection means of delay fluctuation of operation considered as a configuration which detects time amount after giving a command of valve opening of said inlet valve, or clausilium until it becomes the predetermined amount of lifts as a time delay of operation.

[0019] According to this configuration, the operating time until it becomes the predetermined amount of lifts (for example, full open or a close by-pass bulb completely) is detected as a time delay of operation including a dead time after giving a command of valve opening of an inlet valve, or clausilium until an inlet valve actually begins to move, and aim inhalation-of-air path internal pressure is amended according to fluctuation of said time delay of operation.

[0020] In invention according to claim 5, while said amount detection means of delay fluctuation of

operation computed the average of a time delay of operation detected for every gas column, deflection of this average and a time delay of each gas column of operation was computed, and it considered as a configuration which makes maximum of an absolute value of said deflection the amount of fluctuation of said time delay of operation.
[0021] According to this configuration, a time delay of operation is detected for every gas column, and a time delay of operation for every gas column is equalized. And let biggest value in an absolute value of deflection which asked each for deflection of a time delay of operation for every gas column, and said average, and asked for it for every gas column be the amount of fluctuation of a time delay of operation.
[0022] In invention according to claim 6, said amount detection means of delay fluctuation of operation considered as a configuration detected as a value which correlates the amount of fluctuation of an engine speed with the amount of fluctuation of a time delay of operation. Since according to this configuration fluctuation arises in an inhalation air content by fluctuation of a time delay of operation and fluctuation arises in an engine speed by fluctuation of an inhalation air content, fluctuation of a time delay of operation is presumed from fluctuation of an engine speed.
[0023] On the other hand, an inhalation-of-air control unit of an engine concerning invention according to claim 7 is constituted as shown in drawing 2 . In drawing 2 , an aim inhalation-of-air path internal pressure setting means sets up engine aim inhalation-of-air path internal pressure.
[0024] An aim inhalation air content setting means sets up an engine aim inhalation air content. An aim inhalation-of-air path internal pressure amendment means amends said aim inhalation-of-air path internal pressure based on said aim inhalation air content at least.
[0025] And a throttle opening control means controls opening of a throttle valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content. Moreover, an inlet-valve closing motion stage control means controls a closing motion stage of an inlet valve based on said amended aim inhalation-of-air path internal pressure and said aim inhalation air content.
[0026] Since fluctuation of an inhalation air content is comparatively small even if it is the case that the amount of fluctuation of a time delay of operation is [even if] large, when a rate of an actuation time delay which according to this configuration is occupied to the whole valve-opening time amount since there are many aim inhalation air contents and valve-opening time amount of an inlet valve is long is small, when an aim inhalation air content is large, aim inhalation-of-air path internal pressure may be comparatively high, and according to an aim inhalation air content, aim inhalation-of-air path internal pressure is amended.
[0027]
[Effect of the Invention] According to invention according to claim 1, by amending inhalation-of-air path internal pressure according to fluctuation of the time delay of an inlet valve of operation, said time delay of operation reduces the rate of occupying to the whole valve-opening time amount, and can inhibit fluctuation of the inhalation air content by fluctuation of said time delay of operation, and it is effective in the ability to raise operability.
[0028] Preventing that inhalation-of-air path internal pressure is amended small too much, and a pumping loss becomes large according to invention according to claim 2, when there are many inhalation air contents and fluctuation of a time delay of operation is permitted comparatively, when there are few inhalation air contents, it is effective in the ability to inhibit fluctuation of an inhalation air content effectively.
[0029] According to invention according to claim 3, it is effective in the ability to inhibit fluctuation of the inhalation air content by fluctuation of a dead time after giving the command of valve opening or clausilium to an inlet valve until an inlet valve actually begins to move.
[0030] According to invention according to claim 4, it is effective in the ability to control fluctuation of the inhalation air content by fluctuation of the time delay of operation which valve opening or clausilium including said dead time takes. According to invention according to claim 5, when dispersion in the operating time between each gas column is large, it is effective in the ability to amend inhalation-of-air path internal pressure so that the effect of dispersion in this operating time may be controlled.
[0031] According to invention according to claim 6, it is effective in fluctuation of the operating time of

an inlet valve being easily detectable from fluctuation of an engine speed. According to invention according to claim 7, there are few inhalation air contents, and valve-opening time amount required when it has effect to an inhalation air content with big fluctuation of the operating time of an inlet valve, in order to make small inhalation-of-air path internal pressure and to acquire an aim inhalation air content is lengthened, and it is effective in the ability of fluctuation of said operating time to control the effect which it has on an inhalation air content.

[0032]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to details based on a drawing. Drawing 3 is drawing having shown the system configuration of the engine for vehicles in the gestalt of operation.

[0033] In this drawing 3 , air is attracted by the engine 101 through an air intake duct 102, the inhalation-of-air collector 103, and an inlet manifold 104. While the air flow meter 105 which detects an intake air flow is formed, the electronics control type throttle valve 106 is infixed in said air intake duct 102. The fuel injection valve 107 is formed in each branch section of an inlet manifold 104.

[0034] electromagnetism as shows the inlet valve 108 and exhaust valve 109 which are prepared in each gas column to drawing 4 -- it drives with a drive-type actuator. The exhaust air which the ignition plug 110 is formed in the combustion chamber of each gas column, and burned with spark ignition by this ignition plug 110 is discharged through said exhaust valve 109, and is drawn by the exhaust manifold 111. The air-fuel ratio sensor 112 is formed in the set section of said exhaust manifold 111, and an exhaust air air-fuel ratio is detected through the oxygen density under exhaust air in it.

[0035] the electromagnetism of the induction-exhaust valve 108,109 which shows ECU (engine control unit)113 to said electronics control type throttle valve 106, a fuel injection valve 107, an ignition plug 110, and drawing 4 -- while outputting a driving signal to a drive type actuator, the detecting signal from said air flow meter 105 and the air-fuel ratio sensor 112 is inputted. That is, said ECU113 has the function as a throttle opening control means and an inlet-valve closing motion control means.

[0036] Moreover, the detecting signal from the crank angle sensor 114, a coolant temperature sensor 115, an intake temperature sensor 116, the accelerator control input sensor 117, and a speed sensor 118 is inputted into said ECU113.

[0037] next, the electromagnetism of the induction-exhaust valves 108 and 109 shown in drawing 4 -- a drive type actuator is explained. In drawing 4 , the induction-exhaust valve 202 (an inlet valve 108 or exhaust valve 109) is supported possible [sliding] to the cylinder head 201. The bulb retainer 203 is being fixed to the shank of an induction-exhaust valve 202. It is compressed and equipped with the valve spring 204 between the bulb retainer 203 and the cylinder head 201, and an induction-exhaust valve 202 will be energized by this in the direction (the direction of clausilium) which closes port 201a of the cylinder head 201.

[0038] The case member 205,206,207 of equipment is being fixed to the cylinder head 201, and the electromagnet 208,209 is formed in the case. It is fixed to the direct case member 206,207, and the electromagnet 208,209 is installed. Moreover, in the electromagnet 208,209, electric coils 208a and 209a are formed, respectively, and the suction sides 208b and 209b of an electromagnet 208,209 will generate a suction force by current being passed by each electric coil by the drive circuit on it.

[0039] The shaft 210 is installed in the core of an electromagnet 208,209 possible [sliding], and the movable plate 211 which consists of the magnetic substance between suction side 208b of an electromagnet 208 and suction side 209b of an electromagnet 209 is being fixed to the interstitial segment of this shaft 210. This has the composition that said movable plate 211 may be driven in the vertical direction to a shaft 210 and one by a diagram, by whether it is made to energize to any of an electromagnet 208,209.

[0040] Moreover, the spring seat 214 is being fixed to the cylinder head 201 of a shaft 210, and the edge of the opposite side, and the shaft 210 is energized by the operation of the valve-opening spring 215 which was compressed and was installed between the spring housings 216 fixed to the case in the valve-opening direction (facing down of drawing).

[0041] The shaft 210 is formed on the shank of an induction-exhaust valve 202, and the same axle, and

the edge by the side of the cylinder head of a shaft 210 has countered with top-face 202a of the shaft of an induction-exhaust valve 202. Therefore, when the force of the valve-opening direction (facing down of drawing) acts on a shaft 210, a shaft 210 will open push and an induction-exhaust valve 202 for an induction-exhaust valve 202, and when a shaft 210 moves to reverse in the direction of clausilium (facing up of drawing), an induction-exhaust valve 202 will displace port 201a in the direction of clausilium by *****.

[0042] Thus, closing motion of a bulb is enabled by suction actuation of an electromagnet 208,209. A displacement sensor 217 is a sensor which measures the displacement of a shaft 210, for example, detects the displacement of a shaft 210 using a potentiometer.

[0043] Below, it explains based on drawings, such as a flow chart which shows the program performed with a microcomputer in the details of the inhalation-of-air control by the above-mentioned configuration. In addition, each program shown below shall be performed every 10msec(s).

[0044] Drawing 5 is the flow chart of the base which shows the 1st operation gestalt of inhalation-of-air control. In S501 (the amount detection means of delay fluctuation of operation), the time amount (operating time) which the clausilium of the inlet valve 108 of each gas column takes is detected, and fluctuation of the operating time of an inlet valve 108 is computed based on this. in addition, the time amount which clausilium takes -- or it may replace with the time amount which clausilium takes, the time amount which valve opening takes may be detected, and fluctuation of the operating time may be made to compute from this valve-opening time amount

[0045] In S502 (aim inhalation air content setting means), the aim inhalation air content inhaled in a cylinder is computed, and aim inlet-pipe internal pressure is set up in S503 (aim inhalation-of-air path internal pressure setting means).

[0046] In S504 (aim inhalation-of-air path internal pressure amendment means) Said aim inlet-pipe internal pressure is amended based on fluctuation of said operating time. In S505 (throttle opening control means) Aim throttle opening is computed based on said amended aim inlet-pipe internal pressure and said aim inhalation air content, in S506 (inlet-valve closing motion stage control means), based on said amended aim inlet-pipe internal pressure and said aim inhalation air content, the closing motion stage of an inlet valve 108 is computed, and processing is ended.

[0047] Drawing 6 is the flow chart of the base which shows the 2nd operation gestalt of inhalation-of-air control. Aim inlet-pipe internal pressure is set up and the aim inhalation air content inhaled in a cylinder is computed by S602 (aim inhalation air content setting means) S601 (aim inhalation-of-air path internal pressure setting means).

[0048] In S603 (aim inhalation-of-air path internal pressure amendment means), aim inlet-pipe internal pressure is amended based on an aim inhalation air content. In S604 (throttle opening control means) Aim throttle opening is computed based on said amended aim inlet-pipe internal pressure and said aim inhalation air content, in S605 (inlet-valve closing motion stage control means), based on said amended aim inlet-pipe internal pressure and said aim inhalation air content, the closing motion stage of an inlet valve 108 is computed, and processing is ended.

[0049] Drawing 7 is the flow chart which showed in detail the contents of processing of S501 (the amount detection means of delay fluctuation of operation) which computes fluctuation of the operating time in said drawing 5 . In S701, the clausilium time amount Tn (n= 1, --, 4) of the inlet valve 108 of each gas column is measured using the displacement sensor 217 which measures the amount of lifts of an inlet valve 108. Let said clausilium time amount Tn (time delay of operation) be time amount after giving the command of clausilium to time amount after giving the command of clausilium to an inlet valve 108 until it actually starts clausilium, or an inlet valve 108 until clausilium is actually carried out (it becomes the predetermined amount of lifts).

[0050] However, a time delay of operation may be found as time amount after giving the command of valve opening to an inlet valve 108, and a time delay of operation may be made to measure on the both sides by the side of clausilium and valve opening further. Moreover, since the delay of an exhaust valve of operation also affects an engine inhalation air content, it is good also as a configuration which also makes the time delay of an exhaust valve of operation measure with the time delay of an inlet valve of

operation.
[0051] In S702, the average B of the clausilium time amount Tn of each gas column is computed. In S703, the absolute value of deflection Tn-B of the clausilium time amount Tn for every gas column and the average B is computed, and let those maximums be the amounts D of time variation.
[0052] By the way, in above-mentioned drawing 7 , although the clausilium time amount Tn was measured using the displacement sensor 217, since an engine inhalation air content will be changed and an engine speed Ne will be changed by this when there is fluctuation of the clausilium time amount Tn, as it is shown in drawing 8 , said amount D of time variation can be presumed from fluctuation of an engine speed Ne.
[0053] In drawing 8 , an engine speed Ne is first read by S801. In S802, high-pass filter processing (a cut off frequency is 1Hz) as shown in the following formula 1 is performed to said read engine speed Ne, and a low-frequency component is removed.
[0054]
y(k) =0.9695312529x {u(k)-u (k-1)} +0.9390625058xy (k-1) -- For u (k), in the (1) above-mentioned type 1, the newest value of an input of a filter and u (k-1) are [the newest value of a filter output and y (k-1) of the last value of an input and y (k)] the last values of an output.
[0055] Next, in S803, the absolute value of the output of a high-pass filter is calculated. And low pass filter processing (a cut off frequency is 10Hz) as shown in the following formula 2 is performed to the absolute value of the output of a high-pass filter, and S804 is integrated with predetermined period (for example, for 10 seconds) data, and let the result be the amount D of fluctuation of the operating time of an inlet valve 108.
[0056]
y(k) =0.2452372753x {u(k)-u (k-1)} +0.5095254495xy (k-1) -- (2) drawing 9 is the flow charts which showed in detail the contents of processing in S502 and S602 which compute an aim inhalation air content in drawing 5 and drawing 6 (aim inhalation air content setting means).
[0057] In S901, the idle maintenance air flow rate equivalent to the demand air content in idle operation is read, the multiplication of the coefficient which expresses the relation between the throttle passage flow rate in the Sonique style and throttle opening area with S902 to said idle maintenance air flow rate is carried out, and it asks for the idle stabilization part throttle opening area Ai.
[0058] Accelerator opening is read and the accelerator part throttle opening area Aa is computed by S904 S903 from the map which changes accelerator opening into throttle opening area.
[0059] In S905, the idle stabilization part throttle opening area Ai and the accelerator part throttle opening area Aa are added, and it asks for the throttle opening area A. In S906, the throttle opening area A, engine-speed Ne, and displacement V are used. The value ANV (=A/(Ne-V)) which did the division of the throttle opening area A with rotational speed Ne and displacement V is computed. In the following S907 With reference to the map which memorized the target volume flow rate QH0 (volume in the reference condition of new **** to cylinder capacity) according to said ANV beforehand, the target volume flow rate QH0 corresponding to said ANV at that time is computed.
[0060] In addition, the map of said target volume flow rate QH0 is made to correspond, when the open stage IVO of an inlet valve 108 is made into a top dead center TDC and it makes the close stage IVC a bottom dead point BDC, and it is set up.
[0061] Drawing 10 is the flow chart which showed in detail the contents of processing in S503 and S601 which set up aim inlet-pipe internal pressure in drawing 5 and drawing 6 (aim inhalation-of-air path internal pressure setting means).
[0062] The temperature of cooling water is read, the map which sets up aim inlet-pipe internal pressure based on a circulating water temperature in S1002 is searched with S1001, and aim inlet-pipe internal pressure is computed. In addition, aim inlet-pipe internal pressure raises combustion stability by setting up a comparatively small pressure, speeding up the rate of flow of gaseous mixture, and strengthening gas fluid at the time of a cold machine. Moreover, at the time of warming up, specific fuel consumption is made small by setting it as the big value near atmospheric pressure, and reducing inhalation-of-air loss (pumping loss). For example, aim inlet-pipe internal pressure is set to -50mmHg at the time of -

200mmHg and warming up (80-degree more than Centigrade) at the time of a cold machine (0 times less than Centigrade), and suppose at the case of more than 0 times Centigrade to 80-degree less than Centigrade that it is set as the value on the straight line which connects -200mmHg to -50mmHg.
[0063] Drawing 11 is the flow chart which showed in detail the contents of processing in S504 (aim inhalation-of-air path internal pressure amendment means) which amends aim inlet-pipe internal pressure of drawing 5 . The value of Flag Fnew is set to Flag Fold in S1101. In addition, initial value of Flag Fold is set to 0.
[0064] In S1102, the aim inlet-pipe internal pressure Pt is read, and the amount D of time variation is read in S1103. In S1104, the predetermined value epsilon 1 beforehand determined as the amount D of time variation is compared, and size distinction is performed.
[0065] When the amount D of time variation was larger than epsilon 1 at S1104 and it is distinguished, it progresses to S1105 and 1 is set to Flag Fnew. In the following S1106, Flag Fold is distinguished, when it is Fold=1, it progresses to S1107 and processing which subtracts 1 from Variable i is performed.

[0066] On the other hand, when it is Fold=0, it progresses to S1108 and a constant h is put into Variable i. In S1109, positive/negative of said variable i is judged, when it is negative, it progresses to S1110, what subtracted the constant alpha from the aim inlet-pipe internal pressure Pt is made into the amendment inlet-pipe internal pressure Pc, and when said variable i is 0 or a positive value, processing is terminated as [**].
[0067] When only time amount until Variable i specifically becomes negative is judged that the amount D of time variation is larger than epsilon 1 by processing from the above S1105 to S1110, aim inlet-pipe internal pressure will be amended low. For example, when the value of a constant h is set to 300, it continues for 3 seconds and the amount D of time variation is judged to be larger than epsilon 1, it progresses to S1110 and aim inlet-pipe internal pressure is amended low.
[0068] On the other hand, from S1111 to S1116 which performs processing from the above S1105 to S1110, and same processing, when the amount D of time variation was smaller than epsilon 1 at S1103 and it is distinguished, if the duration of the condition that the amount D of time variation is smaller than epsilon 1 exceeds the time amount specified with the value of a constant h, it will progress to S1116 and only a constant alpha will make aim inlet-pipe internal pressure high by processing.
[0069] That is, as shown in drawing 16 to which amendment processing of the aim inlet-pipe internal pressure shown in drawing 11 takes the amount of time variation along a horizontal axis, and takes a load along an axis of ordinate, it is not dependent on the amount of a load, and when the amount of time variation is small, it is high, and when the amount of time variation is large, it amends low. Therefore, you may be the configuration which amends aim inlet-pipe internal pressure in the amount of amendments which distinguishes the amount D of time variation more than a three-stage, and is different according to this distinction result.
[0070] Thus, in order to acquire a target inhalation air content by control of the closing motion stage of an inlet valve if inlet-pipe internal pressure is made low when the amount of time variation is large, the rate of the operating time which necessity produces valve-opening time amount smoothly for a long time, with is occupied to the whole valve-opening time amount will decrease, and fluctuation of the inhalation air content by fluctuation of the operating time can be controlled.
[0071] By the way, it is made dependent on the amount and the amount of time variation of a load, and you may make it make the processing in S504 (aim inhalation-of-air path internal pressure amendment means) which amends aim inlet-pipe internal pressure of drawing 5 perform, as it replaces with what was shown in said drawing 11 and shown in drawing 12 .
[0072] Like S1101 to S1116 of drawing 11 , based on said amount D of time variation, when the amount of operating-time fluctuation is large, the aim inlet-pipe internal pressure Pt is amended low, and in drawing 12 , in each step from S1201 to S1216, when the amount of operating-time fluctuation is small, the aim inlet-pipe internal pressure Pt is amended highly.
[0073] Furthermore, the aim volumetric flow rate ratio QH 0 is read, and a load is judged by S1218 S1217 by comparing the predetermined value epsilon 2 and the aim volumetric flow rate ratio QH 0

which were determined beforehand.
[0074] And in the case of a heavy load (QH0> epsilon 2), it progresses to S1219 and let the result of having added the correction value which carried out the multiplication of the coefficient k and asked the deflection of the target volume flow rate QH0 and the predetermined value epsilon 2 for it to the aim inlet-pipe internal pressure Pt be the final aim inlet-pipe internal pressure Pc.
[0075] The aim inlet-pipe internal pressure Pt is set to the aim inlet-pipe internal pressure Pc final as it is, without adding amendment in the case of Pc=(QH0-epsilon2) xk+Pt one side and a low load (QH0 <=epsilon2).
[0076] That is, as shown in drawing 17 to which amendment processing of the aim inlet-pipe internal pressure shown in drawing 12 takes the amount of time variation along a horizontal axis, and takes a load along an axis of ordinate, when a load is below a predetermined value, it is not concerned with a load, but aim inlet-pipe internal pressure is high when the amount of time variation is small, and when the amount of time variation is large, it is amended low. Moreover, while aim inlet-pipe internal pressure is high when the amount of time variation is small, and being low amended when the amount of time variation is large when a load is beyond a predetermined value, aim inlet-pipe internal pressure is more highly amended by the case where a load is larger.
[0077] Since the effect which it has on the whole valve-opening time amount will be comparatively small even if a load is large, and it is the case that the amount of time variation is large, when the valve-opening time amount of an inlet valve is comparatively long, the need of making aim inlet-pipe internal pressure small becomes thin. Then, it prevents that amend aim inlet-pipe internal pressure according to the load at that time even if the amount of time variation is the same, and label inlet-pipe internal pressure is low amended beyond necessity, and inhalation-of-air loss (pumping loss) increases.
[0078] In addition, when performing amendment of the aim inlet-pipe internal pressure shown in above-mentioned drawing 11 or drawing 12 based on the amount of operating-time fluctuation detected by said drawing 7 , it carries out, when aim inlet-pipe internal pressure is near atmospheric pressure, and when aim inlet-pipe internal pressure is small set up according to the moderation demand, it is not necessary to carry out. That is, the amount of fluctuation of the operating time found from the lift condition of an actual inlet valve in drawing 7 is because the reduction amendment demand of aim inlet-pipe internal pressure will be shown in the degree which does not change even if it amends inlet-pipe internal pressure, but can make fluctuation of an inhalation air content small even if even if it is in the condition that aim inlet-pipe internal pressure is small.
[0079] Drawing 13 is the flow chart which showed in detail the contents of processing in S603 (aim inhalation-of-air path internal pressure amendment means) which amends aim inlet-pipe internal pressure of drawing 6 . In S1301, the aim inlet-pipe internal pressure Pt is read, and the target volume flow rate QH0 is read in S1302.
[0080] From the map which memorized the amount Pr of inlet-pipe internal pressure amendments according to the target volume flow rate QH0, the amount Pr of amendments corresponding to the target volume flow rate QH0 at that time is computed, and by S1304, the amendment inlet-pipe internal pressure Pc is computed S1303 by subtracting said amount Pr of inlet-pipe internal pressure amendments from the aim inlet-pipe internal pressure Pt.
[0081] A value with the bigger time when said amount Pr of inlet-pipe internal pressure amendments has the smaller target volume flow rate QH0 is set up, and the aim inlet-pipe internal pressure Pt is smaller amended by the time when the target volume flow rate QH0 (engine load) is smaller.
[0082] That is, it does not depend on the amount of time variation for amendment processing of the aim inlet-pipe internal pressure shown in drawing 13 , but when a load is small, it is low, and when a load is large, it amends highly.
[0083] Drawing 14 is the flow chart which showed in detail the contents of processing in S505 and S604 which compute drawing 5 and aim throttle opening of drawing 6 (throttle opening control means).
[0084] The target volume flow rate QH0 is read, and the inlet-pipe internal pressure Pc to which amendment processing was performed is read by S1402 S1401. Next, the operation of S1403-S1408 is explained using drawing 18 .

[0085] When inlet-pipe internal pressure is set constant, value A/(Ne-V) and the volumetric flow rate ratio QH 0 which did the division of the throttle opening area A with rotational speed Ne and displacement V serve as proportionality, and serve as relation shown in drawing 18 in a straight line. Here, it will ask for the throttle opening area A so that inlet-pipe internal pressure may serve as desired value, but since there is a limit (QHOmax) in the air content which can control and inhale the closing motion stage of an inlet valve in the condition of the inlet-pipe internal pressure, to the demand air content beyond a limit, the close stage IVC of an inlet valve is considered as bottom dead point BDC immobilization, inlet-pipe internal pressure is made higher than an aim, and it corresponds.
[0086] In order to perform this, in S1403, the slope of a line (inlet-pipe internal pressure is the ratio of A/ (Ne-V) and QH0 at the time of fixed) of drawing 18 is computed with reference to the map beforehand defined based on the aim inlet-pipe internal pressure at that time.
[0087] In S1404, A/(Ne-V) in aim inlet-pipe internal pressure is computed by carrying out the multiplication of the aforementioned inclination to the target volume flow rate QH0, and this is set to ANVe. On the other hand, in S1405, the data in which A/(Ne-V) at the time of considering the inlet-valve close stage IVC as bottom dead point BDC immobilization was shown with the curve of drawing 18 is computed by giving it as a map, and this is set to ANVm..
[0088] In S1406, the aim throttle opening area At is computed by comparing the size of said ANVe and ANVm and carrying out the multiplication of the displacement V to an engine speed Ne to the one where the value is larger in S1407 or S1408.
[0089] The map which changes the aim throttle opening area At into aim throttle opening is searched with S1409, and aim throttle opening is computed. ECU113 outputs the driving signal based on said aim throttle opening to said electronics control type throttle valve 106, and controls the opening of a throttle valve to aim throttle opening.
[0090] Drawing 15 is a flow chart in detail about the contents of processing in S506 and S605 which compute drawing 5 and the inlet-valve closing motion stage of drawing 6 (inlet-valve closing motion stage control means). In addition, it shall fix to a top dead center TDC, and the valve-opening time amount of an inlet valve shall be calculated by the method of showing clausilium time amount below here.
[0091] In S1501, the maximum volumetric flow rate ratio QHOmax at the time of reading the amended aim inlet-pipe internal pressure Pc, and considering as the aim inlet-pipe internal pressure Pc in S1502, and making the close stage of an inlet valve into a bottom dead point BDC is computed using the map data defined beforehand.
[0092] In S1503, the target volume flow rate QH0 is read, based on the target volume flow rate QH0 and the maximum volumetric flow rate ratio QHOmax, it is the following, the valve-opening time amount of an inlet valve is made and computed, and the close stage of an inlet valve is determined S1504..
[0093] the driving signal based on the close stage of said inlet valve in valve-opening time amount =180 degreeCAxQH0/QHOmaxECU113 of an inlet valve -- said electromagnetism -- it outputs to a drive type actuator, and an inlet valve 108 is closed in a top dead center TDC, and an inlet valve 108 is closed with an aperture and said determined close stage.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of invention according to claim 1.
[Drawing 2] The block diagram showing the configuration of invention according to claim 7.
[Drawing 3] System configuration drawing showing the engine of the gestalt of operation.
[Drawing 4] the electromagnetism of an induction-exhaust valve -- the cross section showing a drive type actuator.
[Drawing 5] The flow chart which shows the 1st operation gestalt of control of an inhalation air content.
[Drawing 6] The flow chart which shows the 2nd operation gestalt of control of an inhalation air content.
[Drawing 7] The flow chart which shows detection of the amount of operating-time fluctuation.
[Drawing 8] The flow chart which shows the other examples of detection of the amount of operating-time fluctuation.
[Drawing 9] The flow chart which shows a setup of an aim inhalation air content.
[Drawing 10] The flow chart which shows a setup of aim inlet-pipe internal pressure.
[Drawing 11] The flow chart which shows the amendment of aim inlet-pipe internal pressure based on the amount of fluctuation.
[Drawing 12] The flow chart which shows the amendment of aim inlet-pipe internal pressure based on the amount of fluctuation, and an aim air content.
[Drawing 13] The flow chart which shows the amendment of aim inlet-pipe internal pressure based on an aim air content.
[Drawing 14] The flow chart which shows calculation of aim throttle opening.
[Drawing 15] The flow chart which shows calculation of the closing motion stage of an inlet valve.
[Drawing 16] The diagram showing the property of the amendment of aim inlet-pipe internal pressure based on the amount of fluctuation.
[Drawing 17] The diagram showing the property of the amendment of aim inlet-pipe internal pressure based on the amount of fluctuation, and an aim air content.
[Drawing 18] The diagram showing correlation with A/(Ne-V) and target volume flow rate.
[Drawing 19] The timing chart which shows the effect by fluctuation of the operating time of an inlet valve for every load.
[Description of Notations]
101 -- Engine
102 -- Air intake duct
103 -- Inhalation-of-air collector
104 -- Inlet manifold
105 -- Air flow meter
106 -- Electronics control type inhalation-of-air throttle valve
107 -- Fuel injection valve
108 -- Inlet valve

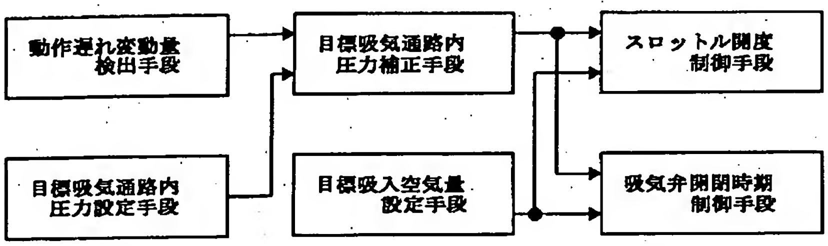
109 -- Exhaust valve
110 -- Ignition plug
111 -- Exhaust manifold
112 -- Air-fuel ratio sensor
113 -- ECU (engine control unit)
114 -- Crank angle sensor
115 -- Coolant temperature sensor
116 -- Intake temperature sensor
117 -- Accelerator control input sensor
118 -- Speed sensor

[Translation done.]

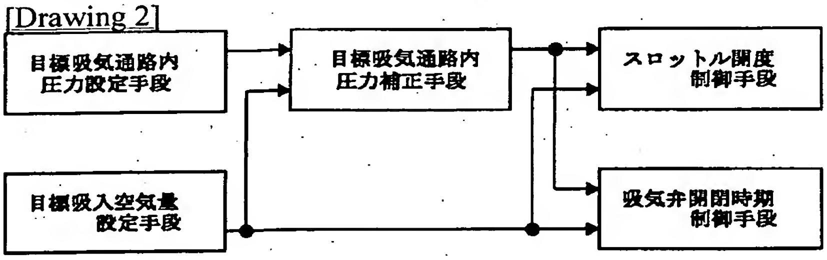
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

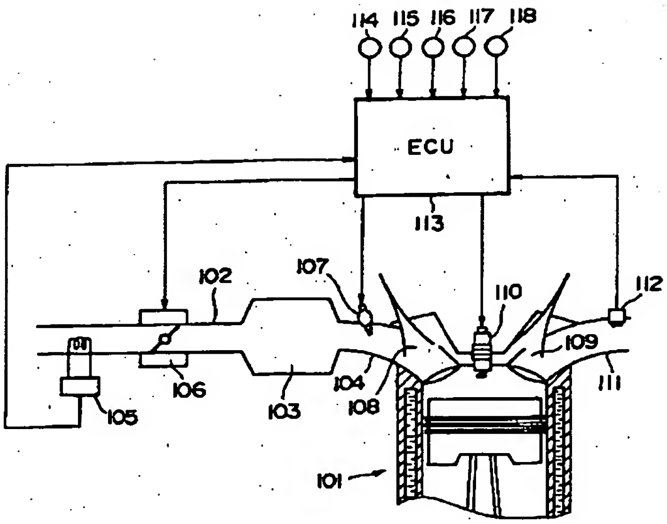
[Drawing 1]



[Drawing 2]



[Drawing 3]



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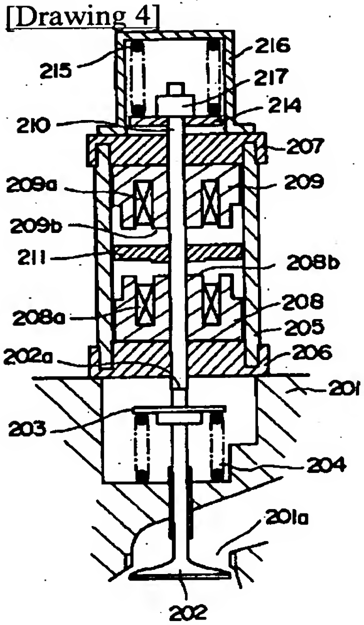

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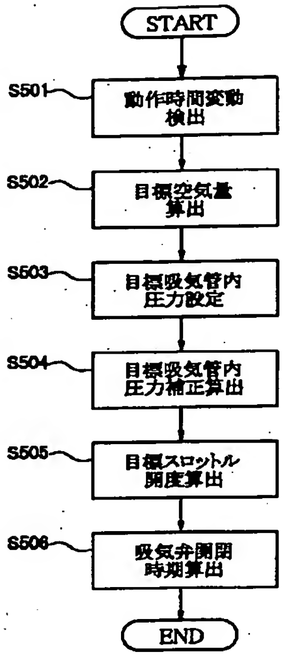

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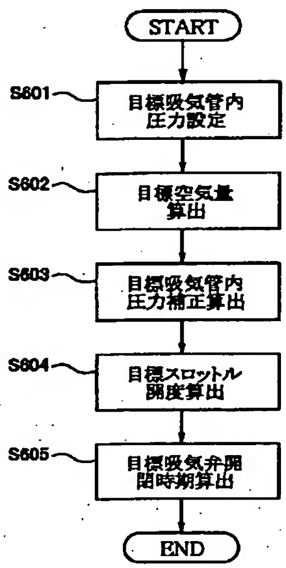

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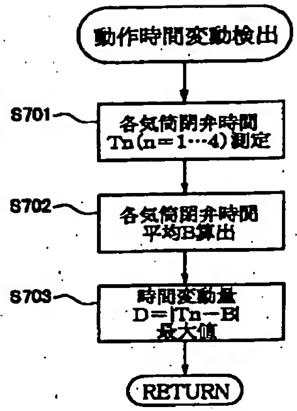

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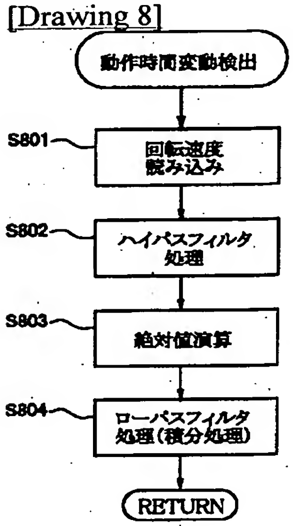
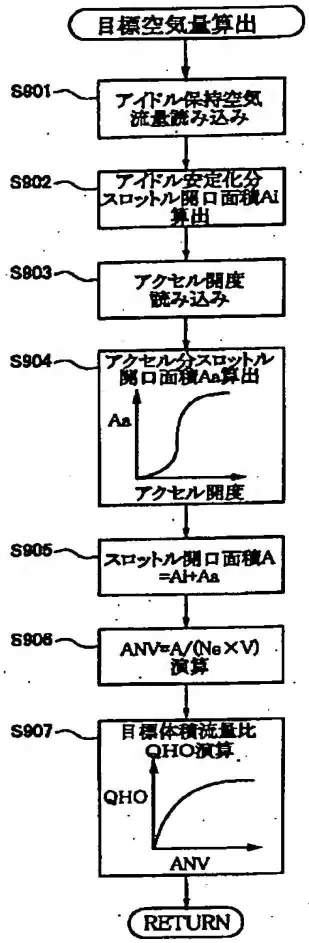
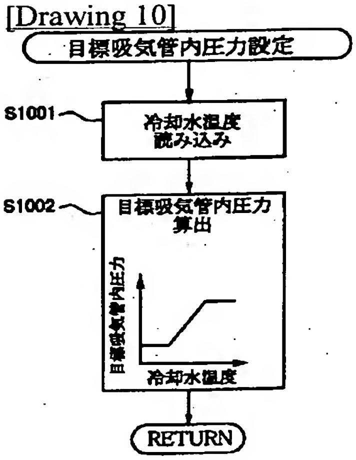


[Drawing 9]



[Drawing 10]



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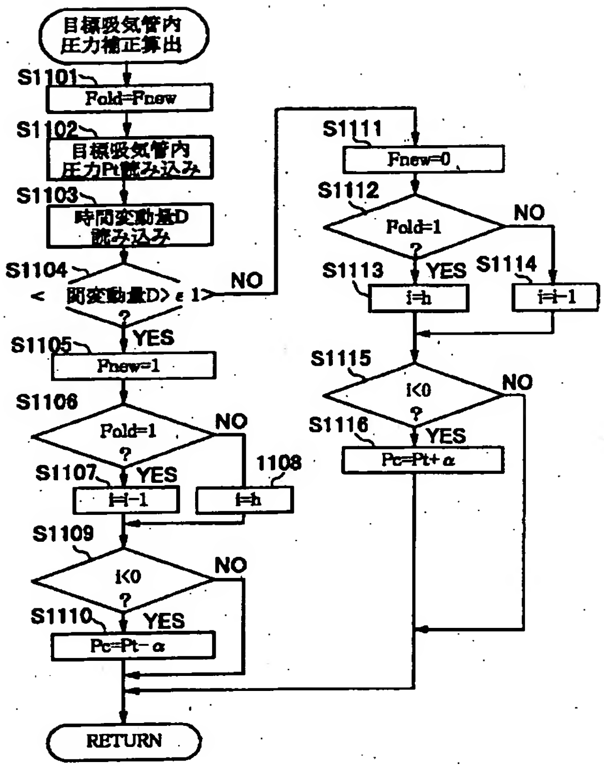
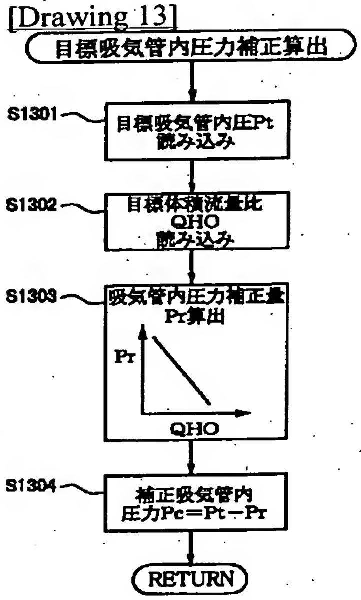
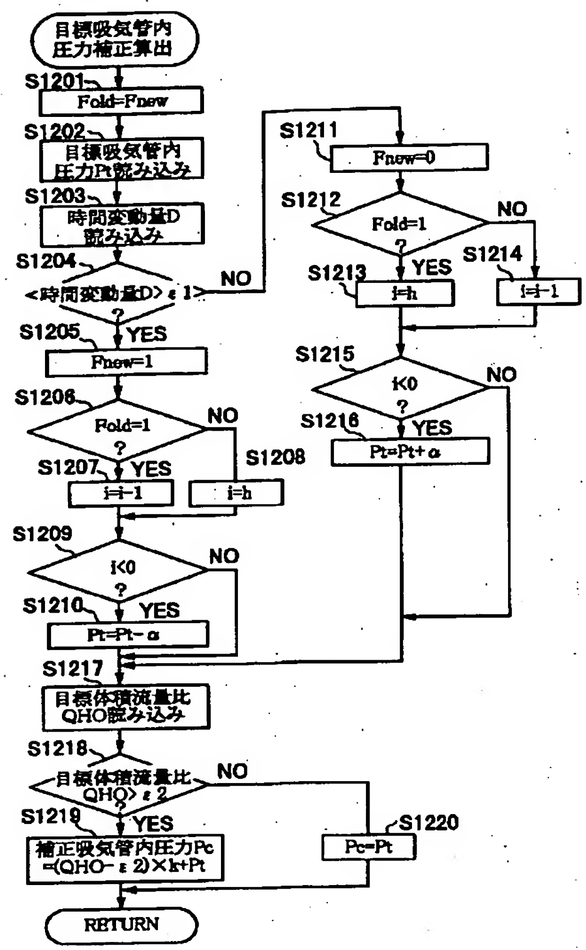


[Drawing 13]

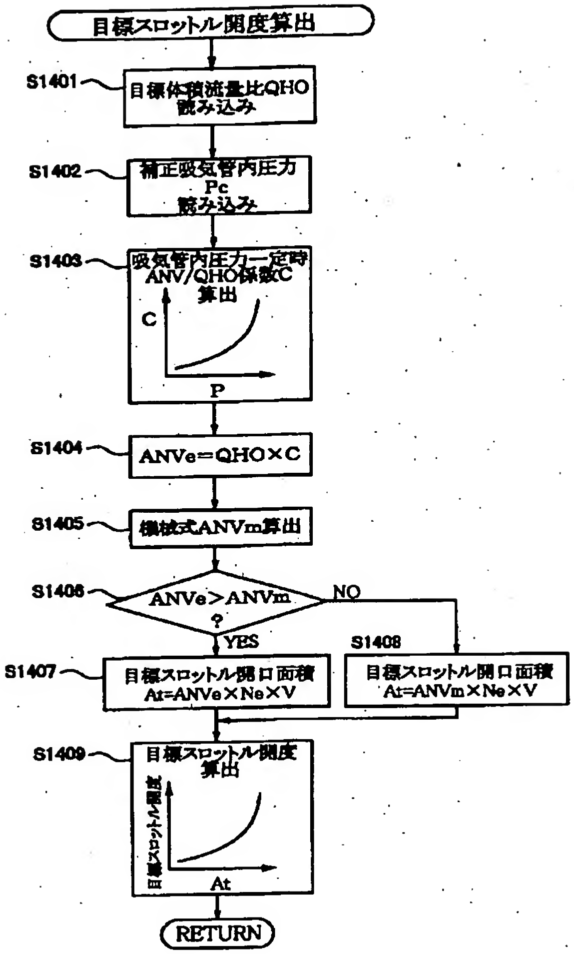


[Drawing 12]

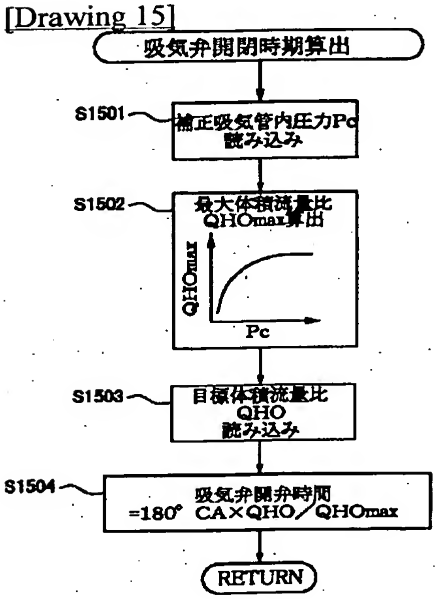


目標吸気管内圧力補正算出
S1201
Fold=Fnew
S1202
目標吸気管内圧力Pt読み込み
S1203
時間変動量D読み込み
S1204
<時間変動量D>ε1>?
NO
YES
S1205
Fnew=1
S1206
Fold=1?
NO
S1207
YES
i=i-1
S1208
i=h
S1209
i<0?
NO
S1210
YES
Pt=Pt-α
S1211
Fnew=0
S1212
Fold=1?
NO
S1213
YES
i=h
S1214
i=i-1
S1215
i<0?
NO
S1216
YES
Pt=Pt+α
S1217
目標体積流量比QHO読み込み
S1218
目標体積流量比QHO>ε2?
NO
S1219
YES
補正吸気管内圧力Pc=(QHO-ε2)×k+Pt
S1220
Pc=Pt
RETURN

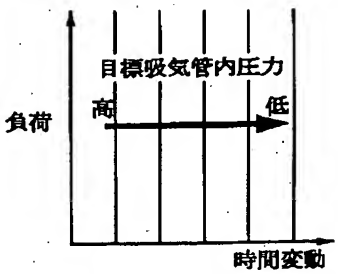
[Drawing 14]



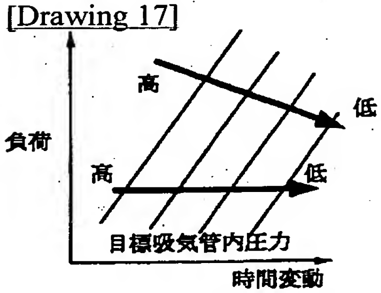
[Drawing 15]



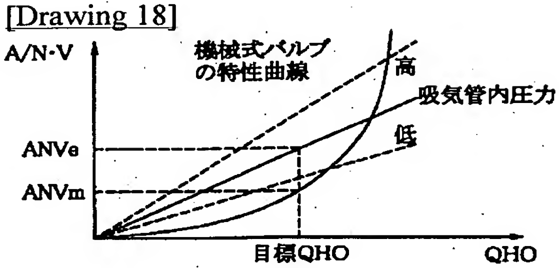
[Drawing 16]



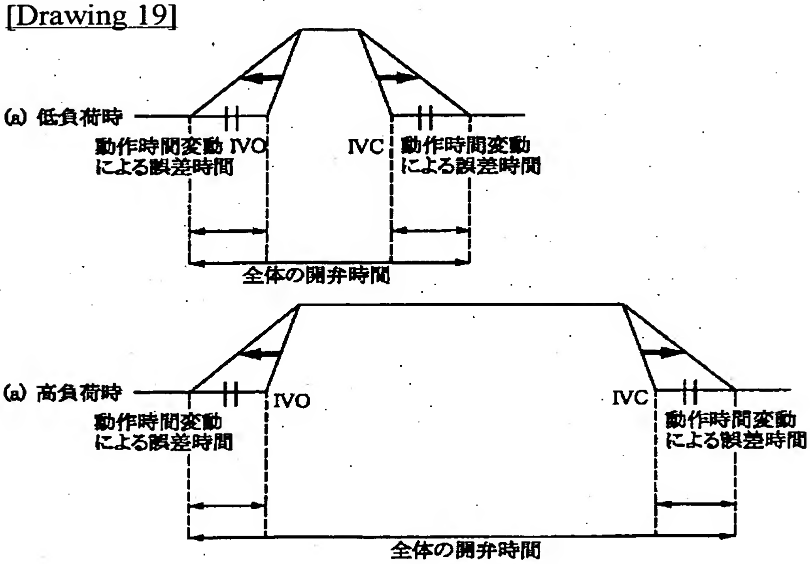
[Drawing 17]



[Drawing 18]



[Drawing 19]



[Translation done.]